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## A New Race of *Pseudobranchus striatus* from Southern Florida

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Field work carried on in the southern portion of the Florida Peninsula during the spring and summer of 1952 has resulted in the taking of eighty-two *Pseudobranchus striatus*. The possibility of southern Florida material being distinct from the central Florida form, *P. s. axanthus*, has been pointed out by Netting and Goin (1942, p. 189), Bishop (1943, p. 19) and Neill (1951, p. 44). Examination of the material at hand indicates that this is indeed the case. The writer takes great pleasure in naming this new form for L. Neil Bell of the University of Miami, whose aid in securing the original series cannot be minimized. The new subspecies may be known as

*Pseudobranchus striatus belli* subsp. nov.

*Holotype*. An adult male, No. **106000**, Museum of Zoology, University of Michigan; taken by Philip C. Porter, L. Neil Bell, and Albert Schwartz on May 17, 1952. Field number AL-TU 1270.

*Type locality*. **23.1** miles west of Miami, on the Tamiami Trail, Dade County, Florida.

*Range*. Known only from the type locality and three miles east thereof. Specimens from Sarasota County, Florida, are intermediate between *P. s. belli* and *P. s. axanthus*.

*Paratypes*. Eighteen adults, as follows: UMMZ **106152-106168** (17), **23.1** miles west of Miami, Tamiami Trail, Dade County, Florida; UMMZ **106002 (1)**, **20.1** miles west of Miami, Tamiami Trail, Dade County, Florida.

*Diagnosis*. A small, slender *Pseudobranchus* with costal grooves numbering **29 to 33** (mean **31.5**) and with a relatively long and narrow head; lateral stripes distinct and wide, buffy in color. *P. s. belli* differs from *P. s. axanthus*, the adjacent race to the north, in having a narrower head and more distinct, wider lateral stripes which are of a different color. From *P. s. spheniscus*, it

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differs in pattern details, coloration, and less pointed shape of the head. From *P. s. striatus*, it differs in coloration, lack of spotting on the venter, and narrower shape of the head. From *P. s. lustricolus*, it differs in having wider lateral stripes and in the color of the venter and its maculations.

*Description of the type.* An adult male, total length 153 mm.; tail length 58 mm. Coloration (in preservative): starting middorsally and proceeding ventrally, the pattern consists of a series of longitudinal stripes; these may be described as follows, with the middorsal stripe being designated as (1). (1) A narrow, middorsal light stripe, Purplish Gray (all capitalized color names from Ridgway, 1912) in color. This middorsal stripe is bounded laterally by (2) a stripe of Deep Slaty Brown, slightly narrower than the middorsal stripe. (3) A narrow stripe, equal in width to the middorsal stripe, and Purplish Gray in color, with a few scattered buffy flecks. (4) A stripe of Deep Slaty Brown, about equal in width to the middorsal stripe plus its two darker bounding stripes. This stripe joins (2) at about the level of the vent, and then forms the dorsal coloration of the tail. (5) A wide, distinct lateral stripe of Capucine Buff, extending from the gills posteriorly to the tip of the tail, widening slightly on the proximal half of the tail, its edges much broken on the middle third of the tail. (6) A stripe of Purplish Gray, wider than band (5) and broken occasionally by clear flecks of Capucine Buff. This band begins at the upper insertion of the forearm, maintains its distinctness about as far posteriorly as the vent, and posteriorly forms the color on the ventral surface of the tail. (7) A narrower, distinct ventrolateral stripe of Light Buff, beginning at the insertion of the forearm, and maintaining its distinctness to just anterior to the vent, where it breaks down into a linear series of Light Buff punctations. (8) The venter is Light Plumbago Gray, with *few* and widely spaced buffy, clear maculations. The throat and ventral surface of the head are Purplish Gray from the level of the gills anteriorly, with scattered lighter buffy punctations. The dorsum of the head is Deep Slaty Brown, unstriped. A buffy line runs from the naris through the eye to the base of the gills. There is a well-marked buffy midventral line on the tail, beginning at the vent and continuing on the ventral fin. Both upper and lower margins of the caudal fin are black spotted.

Forelimbs measure 3.9 mm., with the customary three fingers, each tipped with a black horny cap. The fingers, in order of decreasing length, are 2-1-3; they are not webbed. External gills are three, plumose, and hanging free, not covered by an investing membrane as has been noted for *spheniscus*.

Head somewhat narrower and more tapering than that of paratypes of *P. s. axanthus*. Mouth small, inferior, with upper lips pendulous, as is char-

acteristic of the genus. In profile, head flatter and preorbital region or forehead less sloping than in *axanthus*. Eyes small, lidless, with a covering of skin. Interorbital distance 3.5 mm. Head width (maximum) 5.9 mm.; head length (from tip of snout to base of anteriormost gill) 9.5 mm. Head width contained in snout-vent length 16.1 times; head length contained in snout-vent length 10.0 times.

Body moderately slender for a *Pseudobranchius*, nearly circular in cross section. Body width (maximum) 6.6 mm.; body depth (maximum) 7.0 mm. A middorsal depression and a very shallow midventral groove present. Costal grooves 32, distinct, connecting across abdomen. Vent a small longitudinal slit, located in a circular depression, and surrounded by a pigmentless area.

Tail contained 1.6 times in snout-vent length, almost circular in cross section at the base, and gradually becoming more compressed laterally toward the acute tip. Caudal fin continuous around the tip of the tail, extending over the posterior two-thirds of the tail dorsally, and over the posterior third of the tail ventrally.

*Variation.* The series of eighteen specimens designated as paratypes ranges in size from 107 mm. to 153 mm. These are the largest of the entire series of 82 individuals, all but one having been taken at the type locality. All of the paratypes show the same coloration as the type with but little variation. Four specimens have a light midventral line. A single individual is markedly lighter in overall coloration, the ventral coloration being only slightly darker than the ventrolateral stripe, and the dark stripe between the two light stripes is itself very pale and as lightly pigmented as the venter. In all of the paratypes, the two lateral light stripes are distinct and well marked. Prominent canthal stripes are a common feature in all the paratypes.

Examination of the remainder of the southern Florida material, which has not been designated as paratypes and numbers 63 specimens, shows the same characters as indicated for the type of *belli*. The light lateral and ventrolateral striping may be narrower, but only enough to be in harmony with the small size of the individuals; however, it is always bright and distinct.

Counts of costal grooves for the type and seventeen paratypes show that the grooves number between 29 and 33. Likewise, in fifty-eight specimens on which the costal groove counts could be taken, the highest frequency (24 individuals) is 32. Twenty individuals have a count of 31, while six specimens have a count of 30. Only a single individual has a count of 29, and seven have a count of 33. The mean is 31.5. Comparison of these counts with the available data for the described races of *P. striatus* can be made in

Figure 1. Measurements (extremes) and proportions of the type and eighteen paratypes are as follows (all measurements in millimeters): head length (maximum) 7.0-9.5; head width (maximum) 4.2-5.9; body width (maximum) 4.6-6.6; body depth (maximum) 5.1-7.0; length of forelimb 2.1-3.5; interorbital distance 2.4-3.5. Tail length contained in snout-vent length 1.34-1.65 times; head width contained in snout-vent length 12.7-16.5 times; head length contained in snout-vent length 7.6-10.1 times.

*Comparisons.* *P. s. belli* requires comparison primarily with *P. s. axanthus*, the range of which it is presumed to border on the south, as indicated by Neill (*op. cit.*, p. 46). Comparison of the series of paratypes of *belli* with two lots of *axanthus* paratopotypes (8 specimens) indicates the following differences. The head is relatively longer and more sharply pointed in *belli*. Color and pattern differences are noteworthy; the wider and brighter lateral and ventrolateral stripes are a striking character of *belli* which distinguish it at once from specimens of *axanthus*. In the paratypes of *axanthus* at hand, it is apparent that the ventrolateral light stripe shows a definite tendency to be reduced or obscured, even to the point of becoming a series of dashes or small punctations. Such a condition has not been observed in the entire series of *belli*. The light canthal line is distinct in both adults and young of *belli*. Netting and Goin (*op. cit.*, p. 188) comment upon the general obscurity of these lines in adults of *axanthus*. Comparison of the colors indicated by Netting and Goin in the description of *axanthus* with those observed in *belli* shows that the lateral and ventrolateral light stripes are darker in *axanthus*. While the lateral and ventrolateral stripes in *axanthus* seem to be shades of gray, those of *belli* are more buffy and brighter. The costal groove count of 98 paratypes of *axanthus*, according to Netting and Goin (*op. cit.*, p. 187), varies from 34 to 37, with a mode of 35 and an average of 35.5. A single paratype had the unusually low count of 30. Comparison of these data with those given above for *belli* indicates that *belli* has a consistently lower costal groove count.

Comparison of *P. s. belli* with *P. s. spheniscus* as represented by a single individual from 7.4 mi. south of Marianna, Jackson Co., Florida, two paratypes (young) from south edge of Mossy Pond, Baker Co., Georgia, and from the description by Goin and Crenshaw (1949, p. 277-280), shows that *P. s. belli* differs from that form in having markedly wider lateral and ventrolateral stripes, which are yellowish rather than buffy in color in *spheniscus*. Likewise, the color of the single fresh individual from near Marianna (taken January 24, 1952) is much darker and more bluish than any individual of *belli*. Goin and Crenshaw (*loc. cit.*) state that the type of *spheniscus* has 34 costal grooves; the Jackson County specimen likewise has 34 grooves. Both of these counts are higher than those recorded for *belli*.

*P. s. belli* differs from *P. s. striatus* as known from two specimens from Georgia (no other data) in the lighter coloration of *belli* throughout. The width of the lateral stripe is comparable in *belli* and *striatus*, but the ventro-lateral stripe in the latter is much less well defined and less extensive. The dark venter with the bold maculations differentiates *striatus* from *belli*. The head shape of *belli* and *striatus* is similar, both forms having relatively long heads; that of *belli* is more truncate than that of *striatus*. The costal grooves

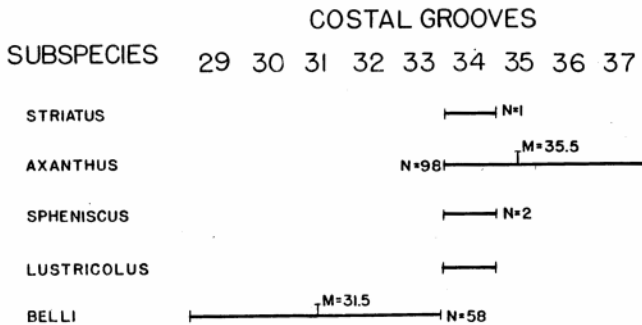


Figure 1. Range of costal groove counts in five subspecies of *Pseudobranchius striatus*, with the mean for two races, as known from the following sources. *P. s. striatus*, Cope (1889, p. 231); see also Netting and Goin (1942, p. 190). *P. s. axanthus*, Netting and Goin (*op. cit.*, p. 187). *P. s. spheniscus*, Goin and Crenshaw (1949, p. 278) and one specimen at hand from 7.2 mi. s. of Marianna, Jackson Co., Florida. *P. s. lustricolus*, Neill (1951, p. 40). *P. s. belli*, 57 specimens from the type locality and one from three miles east thereof at hand.

number higher in *striatus* (*fide* Netting and Goin, *op. cit.*, p. 190, and Cope, 1889, p. 231). Pattern differences between *belli* and the races mentioned above may be noted in Plate 1.

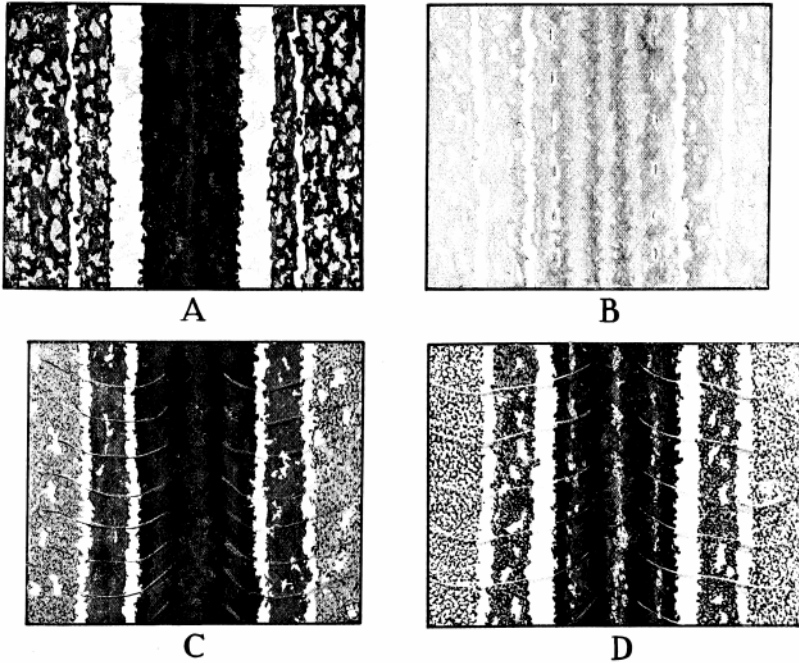
No specimens of *P. s. lustricolus* are available to the writer. Information on this form gained from the original description by Neill (1951, p. 39-46) and especially from the illustration of the pattern in the same publication indicates the following differences. The color of the lateral and ventrolateral stripes is described as medium orange-brown and silvery-white respectively. This differs from the coloration of these two stripes in *belli*. Also the coloration of the middorsal and dorsal light lines is light crome yellow and bright yellow in *lustricolus*, quite different from the more drab gray of *belli*. The ventral coloration of *lustricolus* is described and figured as black with scattered white flecks; this differs from the light slightly punctated venter of *belli*. The costal groove count of *lustricolus* is usually 34 (*fide* Neill, *op. cit.*, p. 40); this

is higher than that of *belli*. Possibly the costal groove counts of *belli* and *lustricolus* overlap, but the range of variation is not stated in the original description of *lustricolus*.

*Remarks.* In the description of *P. s. axanthus*, Netting and Goin stated that there were four specimens available from the southern portion of the Florida Peninsula. They commented (*op. cit.*, p. 189) on the characters of these specimens, noting especially those characteristics which did not agree well with those of *axanthus*. These specimens are one individual from Dade County and three from Englewood, Sarasota County, Florida. The single individual from Dade County has not been examined by the writer. However, the characteristics which Netting and Goin indicated as distinguishing this single Dade County specimen from more northern *axanthus* are well borne out by the present series, even to the coloration of the lateral stripe; this specimen is almost certainly assignable to *belli*. The three specimens from Englewood have been examined by the writer. Of these three individuals, one (a gravid female) is longer (about 164 mm. in total length) and stouter than any specimens from Dade County. The costal grooves number 33. The dorsal coloration is Purplish Gray, and is very close to that of topotypes of *belli*. The lateral stripes are Cinnamon-Buff, wide, and well defined, and the canthal stripe is present but somewhat obscured. The venter is Pale Purplish Gray with scattered clear buffy spots. This specimen is typical of *belli* in pattern, coloration, and number of costal grooves. The other two specimens from Englewood (total lengths 79 and 87 mm.), when compared with *belli* of the same approximate length, are much lighter than the more southern individuals. The lateral and ventrolateral stripes are well defined and buffy in coloration, and the canthal stripe is likewise well defined. The costal grooves of these two specimens number 34 in both cases. The color (due possibly to the length of preservation) largely resembles that of *axanthus*, but the distinctness of the stripes is typical of *belli*. The number of costal grooves in the two immature specimens is higher than that of typical *belli*. It seems best, for want of an adequate series from the lower Gulf Coast of Florida, to refer these three specimens at present to a population which shows characteristics intermediate between those of *belli* and *axanthus*.

Collection of the type series of *P. s. belli* was accomplished through a variation of the method of scooping living water hyacinths (*Piaropus crassipes*) from lakes, sloughs, and canals. During March and early April, 1952, the writer and L. Neil Bell made repeated efforts along the Tamiami Trail west of Miami to secure *Pseudobranchius*. To the south of the elevated roadway there are many small sloughs, about 30 feet in length, which connect with

Plate 1



**Pattern at about midbody of four subspecies of *Pseudobranchius striatus*.**

- A. *P. s. striatus* (Le Conte), UMMZ 53012; Georgia, no other data.
- B. *P. s. axanthus* Netting and Goin, UMMZ 77150, paratype; Alachua Co., Florida, Payne's Prairie, near Gainesville.
- C. *P. s. spheniscus* Goin and Crenshaw, UMMZ 106007; Jackson Co., Florida, 7.2 mi. s. of Marianna.
- D. *P. s. belli* subsp. nov., UMMZ 106000, holotype; Dade Co., Florida, 2.3.1 mi. w. of Miami, Tamiami Trail.

the Tamiami Canal on the north side of the roadway. Most of these sloughs contain either floating, live hyacinths, or masses of decaying hyacinths, which have been killed by spraying in an effort to rid the area of this aquatic pest. Although living hyacinths were repeatedly scooped from several of these sloughs, the only aquatic amphibians taken were *Diemictylus v. piaropicola*, *Amphiuma m. means*, and *Siren lacertina*. On April 15, 1952, Craig Phillips of the Marine Laboratory of the University of Miami returned to a locality at which Bell and the writer had collected repeatedly with no success, and secured a *Pseudobranchus* by dipping in dead hyacinths in muddy water close to shore. With this as an incentive, and with the added possibility that dead hyacinths might be the clue to securing this salamander, Bell and the writer went to a locality 23.1 miles west of Miami. Here a north-south canal connects with the east-west Tamiami Canal. At the time of collection, this connection was temporarily broken because of low water level. Most important, the surface of the branch canal, for a distance of about 30 feet south of the roadway, was covered with the decaying remains of water hyacinths. Dipping out and straining this material resulted in collecting the large series of *belli*. Even at this locality, dipping living water hyacinths, which exhibited luxurious growth in the branch canal just south of the patch of dead hyacinths, yielded no *Pseudobranchus*. In this connection, Neill's observations (*op. cit.*, p. 42) on the habitat of *P. s. lustricolus* in the Gulf Hammock area where the water hyacinth does not occur are of interest.

The writer wishes to thank Dr. Charles F. Walker of the Museum of Zoology of the University of Michigan for advice and criticism during the present study. The plate is the work of William L. Brudon and thanks are tendered him accordingly. For help in collecting the series of salamanders from Dade County, the writer wishes especially to thank L. Neil Bell, Philip C. Porter, Raymond R. Porter, Philip R. Porter, and George P. O'Malley; without their help in wielding the net or pulling the seive, such a large series of these aquatic salamanders would not have been obtained.

*Specimens examined* (all numbers, unless otherwise indicated, refer to specimens in the Museum of Zoology, University of Michigan). *Pseudobranchus s. striatus*: **GEORGIA**, no further data, 2 (50105, 53012). *Pseudobranchus s. axanthus*: **FLORIDA**, Alachua Co., Payne's Prairie, near Gainesville, 8 (77150, 79594); east edge of Payne's Prairie, 27 (100237); Citrus Co., 2 mi. e. of Inverness, 14 (106008). *Pseudobranchus s. spheniscus*: **GEORGIA**, Baker Co., south edge of Mossy Pond, 2 (102764); **FLORIDA**, Jackson Co., 7.4 mi. s. of Marianna, 1 (106007). *Pseudobranchus s. belli*: **FLORIDA**, Dade Co., 20.1 mi. w. of Miami, 1 (106002); 23.1 mi. w. of Miami, 81 (106000, 106001, 106003-6, 106152-68). Intergrades between *Pseudobranchus s. axanthus* and *Pseudobranchus s. belli*: Florida, Sarasota Co., Englewood, 3 (Charleston Mus. 39.277.6).



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